



**North Carolina Department of Transportation
Quality Enhancement Unit
Value Management**



NCDOT Value Management Program Policy and Guidelines

**Version 2.0
February 10, 2012**



Forward

As the population of North Carolina continues to grow, so do the demands of the State Department of Transportation. It is imperative, especially in this current fiscal environment, that the Department embrace the importance of value management principles. The ability to maximize the effectiveness of tax payer dollars is paramount to the Department's success in providing efficient, safe, and reliable transportation to the citizens of North Carolina.

I accepted the position of State Value Management Engineer and the responsibilities of overseeing the Value Management Program in April of 2010. Since that time, it has been my personal goal to ensure that the administration of these valuable programs is performed in such a manner as to fully utilize the knowledge and abilities of the talented pool of planners, designers, engineers, and construction personnel throughout the Department. I am grateful for the opportunity to work week in and week out as a public servant and strive to make the Value Management Program an effective tool for the Department in doing its part for the great state of North Carolina.

If there are any questions or comments regarding any facet of the NCDOT Value Management Program, please don't hesitate to contact me.

Thanks for all that each of you do for the Citizens of North Carolina,



Jeffrey M. Garland, PE, PMP
NCDOT State Value Management Engineer
jgarland@ncdot.gov
919-508-1872

Table of Contents

FORWARD	2
TABLE OF CONTENTS	3
ACRONYMS AND DEFINITIONS.....	6
INTRODUCTION	8
DISCLAIMER.....	9
1.0 VALUE MANAGEMENT PROGRAM (VMP)	10
1.1 Purpose	10
1.2 Goals	11
1.3 Definitions	11
1.4 Roles and Responsibilities.....	11
1.5 VMP Processes	12
1.6 Outputs and Reports	12
1.7 Program Evaluation	12
2.0 VALUE ENGINEERING PROGRAM (VEP).....	14
2.1 Purpose	14
2.2 Goals	14
2.3 Definitions	15
2.4 Roles and Responsibilities.....	15
2.5 VEP Processes.....	20
2.6 Outputs and Reports	28
2.7 Program Evaluation	32
3.0 VALUE ENGINEERING CHANGE PROPOSAL (VECP) PROGRAM	33
3.1 Purpose	33

3.2 Goals	33
3.3 Definitions	33
3.4 Roles and Responsibilities	34
3.5 VECP Processes	34
3.6 Outputs and Reports	34
3.7 Program Evaluation	35
4.0 RISK ASSESSMENT PROGRAM (RAP)	36
4.1 Purpose	36
4.2 Goals	36
4.3 Definitions	36
4.4 Roles and Responsibilities	36
4.5 RAP Processes	36
4.6 Outputs and Reports	37
4.7 Program Evaluation	37
5.0 PRODUCT EVALUATION PROGRAM (PEP)	38
5.1 Purpose	38
5.2 Goals	38
5.3 Definitions	38
5.4 Roles and Responsibilities	40
5.5 PEP Processes	42
5.6 Outputs and Reports	45
5.7 Program Evaluation	45
6.0 RESOURCE CONSERVATION PROGRAM	47
6.1 Purpose	47
6.2 Goals	48
6.3 Definitions	48
6.4 Roles and Responsibilities	48

6.5 RCP Processes	51
6.6 Outputs and Reports	51
6.7 Program Evaluation	53
7.0 CONSTRUCTABILITY REVIEW PROGRAM (CRP)	54
7.1 Purpose	54
7.2 Goals	54
7.3 Definitions	54
7.4 Roles and Responsibilities	55
7.5 CRP Processes	55
7.6 Outputs and Reports	55
7.7 Program Evaluation	56
8.0 POST CONSTRUCTION ASSESSMENT PROGRAM (PCAP)	57
8.1 Purpose	57
8.2 Goals	57
8.3 Definitions	57
8.4 Roles and Responsibilities	57
8.5 PCAP Processes	57
8.6 Outputs and Reports	58
8.7 Program Evaluation	58
APPENDIX A – FHWA CFR 23 PART 627 – VALUE ENGINEERING	59
APPENDIX B – NCDOT VMP POLICY	62

Acronyms and Definitions

AASHTO – American Association of State Highway and Transportation Officials

AGC – Associated General Contractors of America

CPI – Continuous Process Improvement

CR – Constructability Review

CRP – Constructability Review Program

CVS – Certified Value Specialist

Department – North Carolina Department of Transportation

DB – Design-Build is an alternative project delivery method that combines both the project design and the construction under one contract

FFY – Federal Fiscal Year runs from October 1st through September 30th of each year

FHWA – Federal Highway Administration

NCDOT – North Carolina Department of Transportation

PCAP – Post Construction Assessment Program

PDA – Performance Dashboard and Appraisal

PDEA – Project Development and Environmental Analysis

PE – Professional Engineer

PEP – Product Evaluation Program

QEU – Quality Enhancement Unit within the Technical Services Division of the NCDOT

RA – Risk Assessment

RAP – Risk Assessment Program

RCP – Resource Conservation Program

RSA – Road Safety Assessment

SAVE – Society of American Value Engineers which is the U.S.-based international professional society promoting the worldwide use of Value Engineering that governs the certification of Certified Value Specialists.

STaRS – Scheduling, Tracking, and Reporting System

TIP – State Transportation Improvement Program

Tri-Project Managers – For a TIP project, the Tri-Project Managers consist of the Roadway Design Project Engineer, the PDEA Project Group Leader, and the Division Construction Engineer

VE – Value Engineering is the systematic application of recognized techniques by a multi-disciplined team to identify the function of a product or service, establish a worth for that function, generate alternatives through the use of creative thinking, and provide the needed functions to accomplish the original purpose of the project and at the lowest life-cycle cost without sacrificing safety, necessary quality, and environmental attributes of the project. (Title 23 of The Code of Federal Regulations Part 627)

VECP – Value Engineering Change Proposal is a proposal by a Contractor, as outlined by Section 104-12 of the North Carolina Department of Transportation *Standard Specifications for Roads and Structures*, which encourages the Contractor to propose changes in the contract requirements which will accomplish the project's functional requirements at less cost or improve value or service at no increase or a minor increase in cost. The net savings of each proposal is usually shared with the Contractor at a stated reasonable rate.

VEP – Value Engineering Program

VEST – Value Engineering Study Team

VMP – Value Management Program that is operated and maintained within the Quality Enhancement Unit of the Technical Services Division of the NCDOT

VMP Database – A database of information that contains pertinent information and lessons learned from all facets of the Value Management Program.

Introduction

To further establish the Value Management Program (VMP) as a management asset providing the Department procedures to pursue cost efficiencies, mitigate project risks, standardize product approvals, provide resource conservation opportunities, and incorporate construction method considerations into the planning and design of a project, the North Carolina Department of Transportation has developed the Value Management Policy and Value Management Program Guidelines.

The North Carolina Department of Transportation Value Management Program is composed of multiple interrelated department wide programs working together to serve the Department as a vital resource and information clearinghouse. Because of the broad range of responsibilities within the Value Management Program, the VMP guidelines were written to provide overall guidance for the procedures and processes for each of the individual programs. Periodic reviews of these guidelines are performed to ensure that the programs are meeting their intended end goals.

The NCDOT Value Management Program Guidelines (Version 1.0) were initially approved on September 29, 2010. Subsequent additions and revisions to the program resulted in the NCDOT Value Management Policy being approved by Department authorities in November of 2011 (see a copy of this policy in Appendix B at the back of these VMP Guidelines). This document serves as the current operating guidelines for the Value Management Program and is referenced as the Value Management Program Guidelines 2.0.

Disclaimer

In an effort to ensure the effectiveness of the processes, procedures, reports, and outcomes of the NCDOT Value Management Program, the Department reserves the right to make changes and modifications to the guidelines presented within this document on an as needed basis if, in doing so, it is in the best interest of the NCDOT and ultimately the tax payers of North Carolina.

1.0 Value Management Program (VMP)

1.1 Purpose

The purpose of the NCDOT VMP is to ensure the prudent statewide use of resources and revenues. To achieve this purpose, the VMP currently encompasses seven statewide programs that contribute to the Department's overall management objectives of streamlining operations, improving quality and outcomes, reducing costs without compromising function, and increasing the use of environmentally sound and energy efficient practices and materials.

These guidelines will detail the functions and processes of the seven principal value management program areas which are:

- The Value Engineering Program (VEP)
- The Value Engineering Change Proposal Program (VECP)
- The Risk Assessment Program (RAP)
- The Product Evaluation Program (PEP)
- The Resource Conservation Program (RCP)
- The Constructability Review Program (CRP)
- The Post Construction Assessment Program (PCAP)

The figure below is a graphical representation of where each of the individual programs fits in the overall timeline of an infrastructure project as it progresses from the planning phase through maintenance. In addition to the seven principal value management programs, the figure also depicts the ongoing component of "research, reporting trends, proposed policy changes, and overall consulting" that is also a key aspect of the overarching NCDOT VMP.

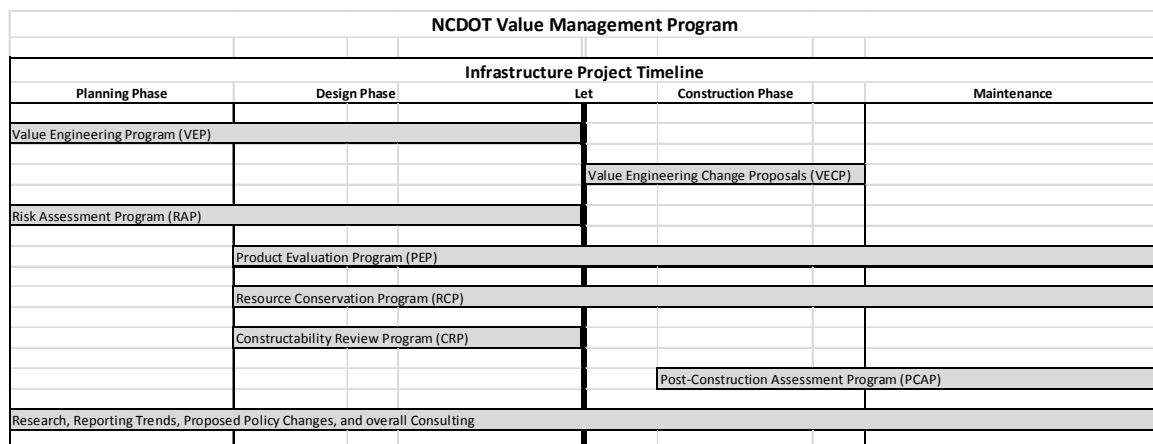


Figure: Depiction of the various VMP Programs in relation to infrastructure project timeline.

1.2 Goals

The overall goal of the statewide Value Management Program is to provide synergy between several value-add management programs and provide a means of communicating trends and lessons learned to the multiple units throughout the Department to enhance the quality of project delivery.

1.3 Definitions

See the Acronyms and Definitions Section of the VMP Guidelines.

1.4 Roles and Responsibilities

Department Leadership

Department leadership shall actively support the VMP by ensuring adequate funding for establishing the overall program and setting clear expectations and performance measures. Department leadership will be called upon by the State Value Management Engineer to serve as a VMP Advisory Panel to aid in bringing consensus and a final disposition on an as needed basis.

Quality Enhancement Unit

The Quality Enhancement Unit (QEU) of the Technical Services Division shall be responsible for managing the VMP which includes establishing guidelines, procedures, training, administering VE studies, and monitoring and reporting overall VMP results and trends. The State Value Management Engineer and other Value Management Engineers will be staffed in the QEU.

State Value Management Engineer

The State Value Management Engineer is ultimately responsible for the overall management and direction of the VMP. Responsibilities include but are not limited to:

- Establishing and maintaining the VMP Guidelines and procedures to ensure the success of the VMP
- Developing annual work plans and establishing program goals
- Supervising the VMP Staff
- Serving as a liaison with Department Leadership and the various Business Units to identify and help resolve VMP challenges
- Determining multimodal transportation projects that would benefit from VMP services
- Providing analysis and synthesis of trends ascertained from the VMP Database
- Using performance measures to track the effectiveness of the VMP

- Effectively advertising the results of the VMP and recognizing individuals that make significant contributions to the VMP

1.5 VMP Processes

The following is an excerpt from the AASHTO Guidelines for Value Engineering (March 2010):

“For optimum results, value engineering should be applied as early as possible in the project development or design process so that accepted VE recommendations can be implemented without delaying the progress of the project. By proper timing and planning, the value engineering manager can usually ensure specific VE studies can be accomplished without conflicting with the project schedule. In fact, the earlier value engineering is applied, the greater the potential for savings. Care must be taken to ensure that the project is ready and the appropriate information is available to perform the study.”

Based on these AASHTO guidelines, all the applicable programs within the VMP are run such that the timing of the studies, evaluations, and reports are at an appropriate time in the project schedule to provide the best opportunity for incorporating the recommendations. The processes for each program are detailed in the individual sections within these VMP guidelines.

1.6 Outputs and Reports

The VMP produces a wide range of outputs and reports for the purposes of communicating value-add information both internally and externally to the Department. A graphical depiction of anticipated 2012 calendar year for the Value Management Program with examples of the type of outputs and reports associated with the overarching Program is included on the following page.

1.7 Program Evaluation

The processes and procedures of the Value Management Program that generate the outputs and reports are evaluated on an ongoing basis throughout the year. A primary goal of the Value Management Program is to consistently evaluate all facets of the program to ensure that it is serving the Department and, ultimately the Citizens of North Carolina, in the most efficient and effective manner possible.

General Overview of Monthly VMP Outputs and Reports

January <ul style="list-style-type: none"> • Bonner Bridge Replacement Phase II Constructability Review • U-3615B VE Study • U-2809A VE Study • VEP Status Update • Business Unit Report 	February <ul style="list-style-type: none"> • I-5000 VE Study • R-2609 VE Study • B-5123 VE Study • PCAP annual workplan • PEP annual meeting with TWGs 	March <ul style="list-style-type: none"> • I-5110 VE Study • U-2925 VE Study • RCP Task Force Meeting
April <ul style="list-style-type: none"> • B-5121 VE Study • R-2597 VE Study • VEP Status Update • Business Unit Report • VEP Training 	May <ul style="list-style-type: none"> • R-4467 VE Study • R-2553 VE Study 	June <ul style="list-style-type: none"> • R-5311 VE Study • R-2544A,B and R-2545A VE Study • RCP Task Force Meeting
July <ul style="list-style-type: none"> • R-4440 VE Study • R-2511 VE Study • VEP Status Update • Business Unit Report 	August <ul style="list-style-type: none"> • R-2582 VE Study • I-4739 VE Study 	September <ul style="list-style-type: none"> • R-2561 VE Study • B-4863 VE Study • RCP Task Force Meeting
October <ul style="list-style-type: none"> • 1-2 VE Studies and Reports • Annual RCP Report • VEP Status Update • Business Unit Quarterly Report • VEP Training 	November <ul style="list-style-type: none"> • 1-2 VE Studies and Reports • FHWA Annual VE Report • Annual Revision of the VMP Guidelines 	December <ul style="list-style-type: none"> • 1-2 VE Studies and Reports • RCP Quarterly Task Force Meeting • PEP Product Annual Recertifications • VMP Year End Report

Figure: graphical depiction of anticipated 2012 calendar year for the Value Management Program

2.0 Value Engineering Program (VEP)

2.1 Purpose

The purpose of the Value Engineering Program (VEP) is to exceed the expectations set forth by the Code of Federal Regulations (CFR) Title 23, Chapter 1, Part 627. This code requires states to utilize a “systematic application of recognized techniques by a multi-disciplined team to identify the function of a product or service, establish a worth for that function, generate alternatives through the use of creative thinking, and provide the needed functions to accomplish the original purpose of the project, reliably, and at the lowest life-cycle cost without sacrificing safety, necessary quality, and environmental attributes of the project.”

In addition, the VEP is dedicated to upholding the NCDOT policy to design, construct and maintain the State Highway System in the most cost-effective and efficient manner possible.

The VEP has established these guidelines and processes as a way of ensuring a systematic program for statewide administration of value engineering techniques and value cost management which meets the FHWA requirements and the policies of the Department. In addition, these guidelines provide authority for administration of the program, assign responsibilities for participation, and outline Federal Highway Administration and internal reporting procedures.

2.2 Goals

The overall goal of the VEP is to provide the means for the NCDOT to utilize value engineering techniques at each major decision point within the project procurement. This may result in scope definition improvements, project designs improvements, project cost savings, accelerated incorporation of new materials and construction techniques into projects, improved constructability, internal and external coordination improvements, reduced environmental impacts, accelerated project schedules, reduced project risk, reduced public inconvenience, improved customer satisfaction and improved transportation infrastructure operations.

Ultimately, the VEP strives to provide the means for the Department to efficiently implement lessons learned throughout the VE process into project design and construction throughout the state.

In addition to these program goals, each year the VEP establishes goals for the VE Studies. These goals are measurable and established based on the anticipated number of projects which meet the minimum FHWA criteria for requiring a VE study, but is not limited to just projects with federal funding.

For FFY 2011, below is a chart showing the goals and the actual results for the year.

Federal Fiscal Year Criteria	Goals	Results
# of VE Studies Performed	25	28
# of Recommendations	80	241
# of Recommendations	40	80
Estimated Savings	\$15 Mil	\$200 Mil

For FFY 2012, below are the goals:

Federal Fiscal Year Criteria	Goals
# of VE Studies Performed	25
# of Recommendations	80
# of Recommendations	50
Estimated Savings	\$20 Mil

2.3 Definitions

See the Acronyms and Definitions Section of the VMP Guidelines.

2.4 Roles and Responsibilities

State Value Management Engineer

The State Value Management Engineer is responsible for the overall management and direction of the VEP. Responsibilities include but are not limited to:

- Developing the annual VE Studies List and VE Studies Work Plan
- Serving as a liaison with Department Leadership and the various Business Units to identify and help resolve VE challenges
- Assigning identified TIP projects to VMP Engineers
- Coordinating with Business Units to determine a VE Coordinator for each Unit
- Coordinating with the VEP Engineer to schedule VE studies
- Promoting and encouraging the use of VEPs and facilitating expeditious reviews of proposals received from Contractors
- Ensuring that VE recommendations are evaluated in a fair and equitable manner and monitoring the implementation of accepted recommendations
- Providing analysis and synthesis of VE trends ascertained from the VMP Database
- Using performance measures to track the effectiveness of the VEP
- Effectively advertising the results of the VEP and recognizing individuals that make significant contributions to the VEP

VEP Engineer

The VEP Engineer is responsible for the day-to-day management of the VEP. Responsibilities include program monitoring, preparing the VE Annual Report as required by FHWA, maintaining VEP procedures and guidelines, maintaining the VEP Database, acting as a liaison between Construction and Preconstruction to disseminate information, facilitating VE Studies as necessary, providing VE training and coaching to NCDOT personnel, and leading continuous improvement efforts related to the VEP. The VEP Engineer will coordinate with the Value Engineer to prepare the VE Study Report. Ultimately, the VEP Engineer will be responsible for action items as assigned by the State Value Management Engineer to ensure the success of the VMP.

Value Management Engineer

The Value Management Engineer is responsible for administering the VE Study for TIP projects on the VE Studies List that have been assigned to them by the State Value Management Engineer. The Value Management Engineer may also serve as the VE Study Facilitator. Responsibilities include administering VE studies at various stages of the project, gathering project information for VE studies, coordinating the space and materials needed to administer VE studies, coordinating between the other value-related programs, performing data entry for the VMP Database by entering the pertinent project information from the VE Studies, working to ensure fully developed recommendations, and identifying additional subject matter experts and/or team members for a VE Study based on the project type and scope. The Value Engineer will ensure that the VE Study is properly documented and coordinate with the VMP Engineer to prepare the VE Study Report. Ultimately, the Value Management Engineer will be responsible for action items as assigned by the State Value Management Engineer to ensure the success of the VMP.

VE Study Facilitator

The VE Study Facilitator will be assigned to each VE Study by the VEP Engineer or the State Value Management Engineer. The VE Study Facilitator will usually be the VEP Engineer or the Value Management Engineer assigned to the project. However, a consultant or other NCDOT employee may be used for this role. The VE Study Facilitator will guide the VE Study team through the VE Process to develop viable recommendations for the assigned project and to ensure the goals of the VE Study are met.

Business Units

The Business Units from various areas within the Department are responsible for coordinating with the State Value Management Engineer and the VEP Engineering in identifying projects that either require or would benefit from VE studies, providing technical information as requested for VE Studies, and designating a Business Unit VE Coordinator. Also as requested by the State Value Management Engineer, Business Units will provide competent, experienced personnel as described in the VE Study Team Selection section to serve as VE Study Team Members. In addition, Business Units should identify personnel who would benefit from VE training in order to fully and effectively participate in VE studies

VE Coordinator

Each Business Unit may elect to appoint a VE Coordinator. The State Value Management Engineer and VEP Engineer will work with the VE Coordinator to assign staff to VE Studies, assist the Value Engineer in gathering project information for studies, and assist in evaluating and fully developing the recommendations from VE Studies that directly relate to that Business Unit.

VE Study Team Member

The VE Study Team Member will be assigned from the Business Units through the collaboration of the State Value Management Engineer, the VEP Engineer, and the Business Unit VE Coordinator. VE Study Team Members should have the appropriate expertise to address the major functional areas and critical high cost issues of the Study. The VE Study Member will be responsible for allocating sufficient time and rearranging priorities in order to fully participate in the VE Study.

State Estimating Engineer

The State Estimating Engineer will assist the State Value Management Engineer, and other Value Management Engineers as appropriate to calculate the cost savings associated with the recommendations resulting from VE Studies.

VE Consultants

VE Consultants may provide any of the following services on certain NCDOT VE Studies as directed by the State Value Management Engineer:

- 1) Provide the team leader/ facilitator only: The Consultant will provide a team leader while the NCDOT provides the study team members. The preferred team leader will hold the PE/CVS certification. The team leader will lead the study team, compile the information for the report, prepare the

report, and prepare/conduct a presentation for management if necessary. Team leader may be a CVS, in lieu of a PE/CSV, only if they have sufficient expertise in transportation related topics and a background in conducting VE studies for highways and bridges. The NCDOT has the right to reject, accept, or request the team leader on a project by project basis.

- 2) Provide a partial team: The Consultant will provide a mix of study team members to complement/supplement the team members provided by the NCDOT. This may or may not include providing the team leader. Team staff provided by the Consultant will be forwarded to the NCDOT for review and approval prior to conducting the VE study. The NCDOT will specify certain disciplines to be provided and minimum experience requirements.
- 3) Provide the entire team: The Consultant will assemble a multi-disciplined VE project team of 5-7 persons, led by a VE Facilitator. Teams should be structured so there is appropriate expertise to evaluate the major problem areas anticipated within the project. NCDOT may add one or two Departmental personnel to participate with the VE team. NCDOT may provide additional assistance and expertise but will not replace consultant VE team members. Team staff provided by the Consultant will be forwarded to the NCDOT for review and approval prior to conducting the VE study.

Recommended qualifications of VE Consultant team members are as follow:

VE Team Leader/Facilitator: This member must be a qualified VE practitioner, experienced in performing and leading VE studies (have participated in several VE studies as a team member and as a team leader), and have sufficient VE training, education, and experience to be recognized by SAVE International as meeting the requirements for certification.

Design, construction, maintenance and traffic engineering expert members: These team members should have at least ten years of experience in design, construction, maintenance or operations. The VE team must also include member(s) experienced in estimating construction costs and cost-benefit analysis. All members should have completed a 40-hour Value Engineering training seminar or have prior Value Engineering experience. The composition of the expertise should reflect the complexity of the project design to be studied. At least two members of the team should be experienced in the high-cost areas of the project.

Safety and Mobility expert member: The VE Team should include expertise to review and provide recommendations in accordance with this policy.

Constructability expert member: This member should be an experienced construction professional who is able to add the Contractor's perspective to the VE Study. As stated above, if a current employee of a construction company is selected by the VE Consultant and participates as a member of the VE study team, the construction company will not be eligible to bid on the project nor partake in any of the construction activities as a subContractor.

Special Note: Value Engineering Consultants will have at least one (1) person on staff that is a licensed Professional Engineer (PE) as well as a Certified Value Specialist (CVS) by the Society of American Value Engineers (SAVE). The PE/CVS should have extensive experience in the design and/or construction of highways and bridges and maintenance of traffic and project scheduling. The Consultant should demonstrate their experience conducting VE studies for transportation facilities, particularly highways and bridges. The Value Engineering team should be able to provide all the services listed in the scope of work.

- 4) Provide training: The Consultant may be requested to provide basic value engineering workshops, team leader training, or management briefings. Training will be in accordance with these guidelines. Training courses provided by the Consultant may include but not be limited to the following:

- SAVE Certified Module I Value Engineering Workshop
- Development and Training of a 3 day VE Workshop for VE Study team members
- Development and Training of a 1 day VE for Transportation Executives

The fee for VE Training will be negotiated on a workshop-by-workshop basis.

- 5) Provide other services: The Consultant may provide other services to complement the VE services. These may include:

- Information gathering for team studies
- Providing facilities for team study activities
- Preparation of VE study report
- Formal presentation of VE findings
- Development of implementation plans

- 6) Additional requirements: The VE team should have CADD capability to develop, analyze, and propose modifications within the VE time schedule.

For all VE Studies, 'Read-Only' CADD files in Micro-Station format will be made available to the VE team.

2.5 VEP Processes

The VEP Process was established to give guidance and to ensure the goals of the program are met. This process can be applied to projects multiple times throughout the planning and design process and preferably prior to major decision making milestones. While the program focuses on projects that meet FHWA requirements for a study, this process can be applied to any project as a way to seek a better more cost efficient method.

VEP Personnel diligently strives to develop and update a process that creates an atmosphere of excellence in an effort to provide a more effective delivery, and streamlines the details to allow more projects to be evaluated by a VE Study Team. The remaining portion of this section details the concerted efforts and steps used to develop a successful Value Engineering Program.

Project Selection:

VEP continuously coordinates with the Unit Heads, Assistant Unit Heads, and Project Engineers in Roadway Design, Project Development and Environmental Analysis, and Design-Build to select projects, coordinate the studies and review the recommendations. The project selection is based not only on FHWA requirements but also based on management recommendations, projects with budgetary constraints, projects with significant changes to scope, and project recommendations from VE Study Teams. This communication plays a critical role in selecting the projects for a VE Study and allows VEP to keep a check of any projects which were not initially selected for a VE Study.

To initiate these discussions for the upcoming FFY, the VEP develops an annual VE Study list each September. The list is compiled based on the requirements found in the CFR 23 part 627 for Value Engineering.

Code of Federal Regulations, Title 23, Chapter 1, Part 627 requires that all projects on the Federal-aid system with an estimated total cost of \$25 million or more shall have a value engineering analysis performed during the development of the project. Bridge projects with an estimated total cost of \$20 million or more shall have a value engineering analysis performed. The total estimated cost shall include all costs associated with the project, including but not limited to design, right-of-way, construction, and administrative costs.

Other projects may be added to the initial list if the project has been recommended by management within the last year but no VE Study has been

conducted. It is a goal of the VEP to conduct VE Studies prior to the Right-of-Way Date when at all possible.

The VEP Engineer also uses the 5 Year Work Plan Let List provided to the Department monthly to develop a list of additional projects to consider for Value Engineering Studies. This list is more extensive than the Federal requirements. While all projects meeting the federal regulations regarding VE studies will be studied, the Department recognizes the potential benefit from conducting VE studies on projects that do not meet these regulations. Therefore, a list of all projects (both federally-assisted and state-funded) with estimated project costs of \$15,000,000 or more is developed in order for these projects to be considered and potentially added to the list of VE Study candidates.

Information included on the initial list typically includes: the TIP Number, the Let Date, the Division, the Project Engineer, the current cost estimate and the project description.

The State VMP Engineer and the VEP Engineer meet with designated Roadway Design, PDEA, and DB staff to review the initial project list and discuss any other potential projects that should be included on the list.

Projects will be added to the list of potential VE studies based on issues that add complexity to the project design. These complexities may include, but are not limited to: critical constraints, complex technical issues, expensive solutions, challenging or unusual circumstances, complicated functional requirements or projects experiencing scope creep.

The types of projects that usually provide the highest potential for value improvement are:

- Projects with alternate solutions that vary the scope and cost
- New alignment or by-pass sections
- Widening of existing highways for capacity improvements
- Major or unique structures
- Interchanges on multi-lane facilities
- Projects with extensive or expensive environmental or geotechnical requirements
- Difficult materials requirements or inferior material sources
- Major reconstruction of existing highways
- Projects with significant traffic disruption or requiring major traffic control
- Projects with multiple stages
- “Shelf projects” that have been reprogrammed

A project that is below the \$15,000,000 threshold but that would benefit from a VE study may be submitted by the various NCDOT Business Units as a candidate project for a VE study. Recommendations are also requested from the

VE Study Teams at the conclusion of each VE Study. This allows Department staff to participate in the selection of a project based on their experience with the VE Process and their current project workload.

Once the State VMP Engineer and the VEP Engineer finalize the list of projects, tentative dates for the VE Studies are selected. The date selected is based on the Let Date ensuring the projects with the nearest Let Date are scheduled first. Otherwise, VE Study dates are scheduled approximately every 2-3 weeks taking into consideration the Board of Transportation Meeting dates and holidays.

Quarterly status updates (October, January, April and July) are sent to the Department managers to inform them of the anticipated dates for Value Engineering Studies. The update will also be posted on the VMP website. This status update project list is a fluid document that changes quarterly to keep the Department informed on the current status of a project and also to ensure the date of the VE Study coincides with stage in the procurement process that would result in viable recommendations for the VE Study. This quarterly update has provided an invaluable avenue for improved communication, coordination, and accountability for Value Engineering Studies.

Study Timing

As part of the ongoing coordination with Department Management, the VEP Engineer verifies the project selected to be evaluated during a scheduled VE Study is at a point in the procurement process that would benefit from the evaluation. This is most critical with the projects being reviewed during the planning stages. In FFY 2011, projects from the planning stages were added to the candidates VEP considers for VE Studies. This addition has proven to be a beneficial format to formally capture value engineering ideas already being discussed by PDEA. It also allows the recommendations to be incorporated into the early stages of design. With the additional projects from the planning stage, the VEP has identified four primary windows of opportunity for a VE Study to be conducted. A project may be studied at any or all of the four stages. However, the main VE Study conducted between CP 4A and CP 4B is required for all TIP projects on the VE Study List. More detailed information regarding the windows for a VE Study is detailed elsewhere in these guidelines. However, to aid in the understanding of the windows as they relate to the timing a study would be scheduled, below is the VE Study Windows:

- **VE Study Window 1 – Planning Stage 1**

The first opportunity for a VE Study is between the Scoping Meeting and Concurrence Point 1. The VE Study will focus on such items as purpose and need, project limits, scope, functionality, constraints, red flags, and potentially costly impacts.

- **VE Study Window 2 – Planning Stage 2**

The second opportunity for a VE Study is between Concurrence Point 1 and Concurrence Point 2. The VE Study will focus on functional designs, constraints, preliminary impacts, scope, project limits, potentially costly impacts, some initial constructability issues, and access issues.

- **VE Study Window 3 – Main VE Study**

The Main VE study is scheduled after Concurrence Point 4A (CP4A), which deals with avoidance and minimization efforts and before Concurrence Point 4B (CP4B), which is a review of 30% complete hydraulic design plans. The VMP Engineer is responsible for activating the study activity in STaRS.

- **VE Study Window 4 – Constructability Reviews**

The final opportunity for a VE Study is between CP 4C and Finalizing the Permit.

Study Duration

The duration of the VE Study is based on the complexity of the individual project as well as which VE Study Window the project is categorized. Projects early in the planning process (i.e. VE Study Windows 1 and 2) may be allotted one-half day to a day for the VE Study duration. Larger projects in the design stage (i.e. VE Study Window 3) may be allotted two days for discussion.

VE Study Team Selection

VE studies incorporate the use of a multi-disciplined team of experts to provide a broad perspective of ideas that address complex engineering issues. VE Study Team participants are selected based on an individual's expertise and the challenges of the specific project being studied. VEP coordinates with each business unit in selecting a candidate that would most effectively participate in the VE Study.

In addition to the internal NCDOT personnel who participate in VE studies, Private Engineering Firms were also contracted to conduct VE Studies or to participate as part of an internal VE Study Team.

A goal of the VMP is to foster innovation by providing a forum for team members to work together and evaluate project elements in an environment conducive to value engineering principles.

The Department may utilize various options to staff VE study teams. These options include the use of a VEST assigned to one project, a VEST assigned to study multiple projects, and the use of VE Consultants to perform part or all of one or multiple VE studies. VE Consultants must be prequalified in VE prior to a

task order being added to a current limited services agreement to perform a VE study.

The VEST approach uses neutral facilitators for process management and coordination and utilizes VE Team Members from multiple technical Business Units who are unfamiliar with the project for project review and the development of recommendations. The VEST will generally be comprised of 5 to 7 team members and a majority of the team members should have previous VE training and experience. Team members will be representative of the discipline areas most affected by the project or issue and should have diverse backgrounds relevant to the specific study. Local agencies, other state agencies, and community groups may also be invited to participate as team members or subject matter experts on a case by case basis depending on project issues. VE Consultants may also be used to augment the VEST. Assignment of persons directly involved in the development of the project should be avoided.

Team members should have the appropriate expertise to address the major functional areas and critical high cost issues of the study, and must be committed to the time required for the study. It is preferred that team members be engineers with a minimum of five years of experience. For best results the team members should have received VE training prior to participation on a VE study.

Due to the fact that VE study recommendations form the basis for important project management decisions, it is preferable for the selected team members to have achieved Advanced or Journey levels in their specific area of knowledge. As an exception, a VEST member may be selected to participate in a VE Study at the Contributing level in a mentored capacity or if they are Professional Engineers.

Expertise levels are defined as:

- **Advanced** – Sufficient experience to review and critique work developed by advanced level professionals within the specified discipline for a project of similar complexity as the project being studied
- **Journey** – Sufficient experience to perform advanced quality work within a given discipline independently for a project of similar complexity as the project being studied
- **Contributing** – Experienced in providing support level work within a discipline for a project of similar complexity as the project being studied

Logistics

In addition to the coordination involved in selecting the projects and the VE Study Teams, there are many details necessary to ensure a successful VE Study. A

check list has been developed to ensure the logistical details are completed. The electronic copy of this check list is found in the Value Management Group Master Directory electronic files. An overview of the items on the list include are:

- The VEP Engineer will reserve the facilities to be used for the VE Study
- The VEP Engineer will assemble all current project data and cost estimate. The Business Units are to work closely with the VE Specialist to provide the data from their Unit in a logical order, including any value decisions that were recorded for the project outside of any VE Studies
- Set up electronic file for project. (See S:/ Drive master directory for folders)
- Complete Pre-Study and During Study documents, forms, letters, presentations, etc.

Conducting the VE Study

Prior to conducting a VE Study, preparation is needed to ensure the study is effective. One enhancement the VEP provides to participants prior to the VE Study is a Value Engineering Packet. This packet of information gives a general overview of the project but more importantly provides participants with the Value Engineering Process. This allows participants to attend the workshop prepared without knowing all of the details related to the project.

The VE Study process shall be conducted in accordance with the following six phases of the internationally recognized VE Job Plan:

(1) Information: The team gathers information about the present design and cost, then determines the needs, requirements, and constraints of the owners, users, and/or stakeholders, as well as the design criteria.

(2) Function Analysis: The team defines the project functions using a two word active verb measurable noun context. The team analyzes these functions to determine which need improvement, elimination, or combination. Tools used during this phase include: Random Function Identification, Function Analysis System Technique (FAST), Function Listing, and Value Index

(3) Creative: The team uses a variety of creative techniques, such as brainstorming, to generate alternative ideas to perform the project functions

(4) Evaluation: The team refines and combines ideas, develops functional alternatives, and evaluates by comparison. Appropriate tools of comparison include advantage and disadvantage comparison and an evaluation of a 1, 0 or -1. These designations are used after a discussion of each idea. A rating of 1 is the decision by the team to carry the opportunity forward to development. If more discussion on the idea is needed, a 0 rating is given. An idea which will not be carried forward for development will receive a -1 rating. By the end of the

evaluation step in the VE process, all ideas will have a 1 or -1 rating. The opportunities given a 1 rating are now identified as recommendations.

(5) Development: Based on the evaluation phase, the team begins to develop in detail the recommendations carried forward. During this phase it is essential to establish costs and backup documentation needed to individually convey the alternative solutions.

(6) Presentation: The final phase of the VE study in which the VE team presents to management the findings of the study in a written report. The VE Study Team will use the Recommendation Form to record all of the final recommendations for the project as provided by the VEP Engineer.

The VEP Engineer will compile the recommendations as part of a VE Study report to send to the appropriate Business Units. The Business Unit VE Coordinator will make a final determination to accept, modify, or reject a recommendation and forward the recommendation to the VEP Engineer. A written justification, based on sound engineering principles, must be supplied with all recommendations that are accepted or rejected. This phase may also include a verbal presentation.

The VM Engineer will record the study recommendations and the final decisions in the VMP Database.

Design-Build Projects

The following is an excerpt from the AASHTO Guidelines for Value Engineering (March 2010):

“Use of design-build (DB) for program delivery is increasing in the transportation sector. With this method, since both design and construction are happening simultaneously, owners often are under the impression that they are getting the best solutions to the given situations and that formal VE studies are not necessary. Opportunities for VE in DB project delivery do exist, although tactics and goals may differ from VE studies in the traditional design-bid-build.”

DB projects that meet the federal VE requirement, as stated in 23 CFR 627.5(5)(e), shall have the VE study performed prior to the release of the request for proposal (RFP) document. Numerous opportunities exist in the DB procurement process in which VE can be advantageous and desirable.

Planning/Scoping – *At this stage, the goals of the VE study are focused on identifying alternates that address purpose and need, defining project scope and budget.*

Draft RFP – The purpose of the VE study at this phase is to refine the design and to assist development of the RFP. It is a useful tool to ensure that the RFP language will produce a project that meets the intended scope of the project.

Proposal Development – VE is a proven tool which can be utilized by DB teams to develop a winning proposal.

After Selection of DB Team, Prior to Notice to Proceed (NTP) – VE can be used to validate and further refine scope and cost of the project. A VE study at this stage can save the owner money by reducing risk to DB team in delivery of the projects.

Post-NTP – VE can be used after the project is underway to assess the design in later stages (say 30-45% design) and also to address issues and problems later in the design and construction.

With the increase in use of the DB for transportation projects, proper application of VE builds upon the strengths and advantages of the DB project delivery process so that projects can be delivered better, at a lower cost, faster, and with fewer problems.”

The State Value Management Engineer and VEP Engineer coordinates with the Director of the Transportation Program Management Unit and the Design-Build Project Engineer to determine VE Study opportunities to ensure that the VE requirement is met for the Department's DB projects as stated in 23 CFR 627.5(5)(e).

VE Studies for DB Projects are typically pursued once the initial draft of the RFP has been printed. The VE Study Team reviews any preliminary plans and other project data but focuses on reviewing the RFP. During the VE Study, the team seeks ways to clarify the document in order to reduce risks which could reduce the overall cost of the contract. The Team asks questions of the RFP which a DB may bring forward during the DB procurement process and provides suggestions for ways to address the questions. In addition, NCDOT includes an ATC provision in each DB contract. This provision allows the DB team to request exceptions to the RFP in order to reduce the cost of the design while still providing the expected functions of the project. Because the DB process is inherently Value Engineering itself, NCDOT is continuously seeking ways to utilize the internal VE Process to ensure the RFP does not preclude the DB from pursuing various options. Internally incorporating VE into DB is a continuous process improvement opportunity.

Unique Opportunity:

The VEP is also receptive to aiding Business Units with special requests to facilitate the Value Engineering process for any challenge the Unit is facing. As an example, during the FFY 2011, Division 3 provided VEP a unique opportunity to review 8 individual projects. The recommendations and suggestions developed within the VE study were used by the Division Engineer and other managers as an effective tool to efficiently manage Division financial resources.

2.6 Outputs and Reports

VE Study Reports

All VE studies will be conducted according to AASHTO and FHWA guidelines. A memorandum from FHWA dated May 25, 2010 with the subject line "Updated FHWA Value Engineering (VE) Policy" notes that the production of a formal written VE study report will include at a minimum the following:

- project information
- identification of the VE analysis team
- background and supporting documentation, such as information obtained from other analyses conducted on the project (e.g., environmental, safety, traffic operations, constructability)
- documentation of the stages of the VE Job Plan which would include documentation of the life-cycle costs that were analyzed
- summarization of the analysis conducted
- documentation of the proposed recommendations and approvals received at the time the report is finalized
- documentation of the proposed and approved recommendations, and related information to support the State DOTs and FHWA's VE program monitoring and reporting
- the formal written report shall be retained for at least 3 years after the completion of the project (as specified in 49 CFR 18.42)

and for bridge projects, the VE Analyses must:

- include bridge substructure and superstructure requirements based on construction material
- be evaluated based on:
 - an engineering and economic bases, taking into consideration acceptable designs for bridges
 - analysis of life-cycle costs and duration of project construction

This report is sent to DOT management for consideration. After reviewing the recommendations, the VEP is given the final disposition for each of the recommendations. When approved, recommendations are incorporated into the

design. The VE Study report is provided to management within 10 days from the end of the VE Study. Management then returns the conceptual response and often the final disposition of the recommendations within four weeks of the report date. This process has streamlined the ability to submit recommendations, receive responses and track the projects for annual reporting. The quarterly status reports described elsewhere in this report are an effective tool to ensure the reports are on track.

The participating VE Study Team also receives a copy of the report as well as a copy of the management response. This demonstrates to the VE Study Team that the time and effort provided as part of the VE Study is part of a larger process that is making a difference in the decisions made within the design of a project.

VE Annual Report

The State Value Management Engineer and the VEP Engineer will be responsible for preparing the annual VE report and providing it to FHWA upon request at the end of each FFY. This report provides an overview and summary of the VEP during the previous FFY. Information regarding NC VEP Policy, coordination, guidelines, training, goals & measures, evaluations, reporting, and cost savings are some of the required elements of the report. VEP sets annual goals to exceed the expectations of FHWA.

Other Outputs

In addition, the VMP Engineer will be responsible for monitoring program compliance with NCDOT policies, procedures, and standards, as well as Federal VE requirements. Specific areas to be monitored and reported at various time throughout the year will include but are not limited to the following:

- Department VE Studies List
- Annual VE Studies Work Plan
- Department VMP accomplishments
- Documentation of VE activities
- Economic analysis methods used in cost/benefit determinations for project decisions
- Compliance with the VMP Guidelines
- Revisions to the VMP Guidelines on an annual basis

Report Clearinghouse

The VMP Database is a collection of the data from all VE reports and aids the VEP staff in tracking and monitoring the status of each project. The VEP Engineer is responsible for the coordination, initial input and updating the project data. In addition, the VEP Engineer is also responsible for reporting, analyzing,

documenting results and trends, making recommendations, and disseminating the results throughout the Department. Additional reports may be requested throughout the year. The database provides the VEP Engineer access to various types of VE Study information related to the VEP.

VE Recognition Program

The VEP values the contributions of the VE Study participants and other VEP supporters. Department leadership strives to fairly and equitably recognize and reward individuals and teams for excellence in service to the overall mission of the Department. The VEP supports the Department's recognition efforts and has established a VEP Recognition Program. This Program acknowledges employee contributions and achievements that enhance organizational performance, support organizational goals and objectives, and improve project value and quality.

Individual Recognition Awards

Secretary's Value Engineering Champion Award

This award is designed to honor those managers and supervisors who, as leaders, have significantly contributed to organizational goals and objectives by identifying and achieving cost savings and visibly supporting the objectives of Value Engineering within the Department.

Nominations for this award are based on meritorious contributions of unusual value to the Department in meeting its strategic goals through support of the VMP. Examples of such contributions include but are not limited to:

- accomplishment of assigned role in such an outstanding manner as to be clearly exceptional among all those who have performed similar duties
- development and improvement of methods and procedures which have accomplished extraordinary results for the Department
- exceptionally outstanding leadership which resulted in the highly successful accomplishment of the Department's VE goals
- leadership, accomplishments, or actions that make a significant contribution to building a continuously improving / learning organization
- demonstrated an outstanding ability to manage outcomes by creating an organizational environment that allows every employee to reach his or her full potential and fully contribute to the DOT's mission
- nurtured and supported the development of employees to ensure a future complement of value engineering leaders
- improved customer satisfaction with transportation systems and Departmental services

Outstanding Achievement Award

This award is designed to honor those team members who have successfully participated on VE studies. The recognition items are presented for team members who fully participate in the most studies. Typically one of these awards will be given, but final determination is based on the decision of the State Value Management Engineer and the VEP Engineer.

Team Recognition Awards

Secretary's Most Outstanding VE Achievement Award

This award is presented to VE Study Teams to recognize meritorious contributions of high value to the Department, and whose exceptional performance results in the improvement, reinvention, or reengineering of practices, products, and/or operations.

Nominations for this award must specifically address all of the elements included in each of the following categories:

Teamwork – Describe how the members of the team/group worked together effectively either within the Department, across Business Units, or with external stakeholders to coordinate and carry out the study to achieve objectives. At least one example of an activity that displays cooperation, coordination, or group process skills is required.

Problem Solving – Describe how the members of the group or team effectively use problem solving methods, techniques, and tools (as appropriate) to achieve desired objectives and/or integrate objectives, procedures, etc., of participating Business Units.

Creative and Innovative Techniques – Describe any innovative techniques used by the team to develop recommendations for improvements. The work of the team should reflect an awareness of evolving methods, procedures, and technologies. Where appropriate, highlight techniques that promote cooperation and collaboration among the Business Units.

Results – Describe results accomplished by the team such as objectives met, solutions found, and process changed or improved.

In addition to the awards described above, Business Units are expected to support the VMP by acknowledging the contributions and achievements of employees. Supervisors and managers are expected to use various methods of recognition to encourage employee support of the VMP.

VE Training

The Value Management Group will conduct Value Engineering Workshops periodically for the development and training of NCDOT staff. Participants will be selected in coordination with the various Business Units to ensure the workshop includes a diverse group of disciplines and experience levels.

Each VE Workshop will be a minimum of 3 days. During this time, participants will:

- Learn the fundamental concepts of value engineering
- Learn the steps of the value engineering process
- Apply the concepts to an assigned project
- Present their recommendations to other participants
- Learn how the different groups within Value Management can be used

2.7 Program Evaluation

The processes and procedures of the VEP are evaluated on an ongoing basis throughout the year. A primary goal of the VEP is to consistently evaluate all facets of the program to ensure that it is serving the Department and, ultimately the Citizens of North Carolina, in the most efficient and effective manner possible.

Revisions to the program will be reflected in the Value Management Program Guidelines that are updated on an annual basis. This re-evaluation process will provide the Department an opportunity to modify this program as necessary to incorporate any changes that will enable the program to operate in a more effective manner.

3.0 Value Engineering Change Proposal (VECP) Program

3.1 Purpose

According to American Association of State Highway and Transportation Officials (AASHTO), Value Engineering (VE) principles can be applied during the construction of the project through VECPs. A VECP program to encourage contractors to develop construction VEC proposals allows the state to benefit from a contractor's design and construction ingenuity, experience, and ability to work with new techniques. Some elements of a successful, ongoing VECP program are:

- Processing of proposals must be kept simple and done so as not to delay the contractor's construction schedule.
- Cost savings are shared between the contractor and the implementing agency.
- Change proposals become the property of the state and the concept may be used on future projects.
- Change proposals should not compromise any essential design criteria or preliminary engineering commitments.
- Change proposals cannot be the basis for a contract claim. The implementing agency has the option to reject, with good justification, contractor's proposals.
- It is essential that all VE team recommendations and contractor proposals be fairly reviewed and expeditiously evaluated for implementation.

As part of every NCDOT construction contract, it is stated that the Contractor shall complete the contract in accordance with the NCDOT 2012 *Standard Specifications for Roads and Structures*. Section 104-12 of these specifications contains the Department's policy on VEPs. It is the NCDOT's policy to provide all Contractor's that are awarded projects in our State an incentive to pursue cost reduction proposals with the Department as it is in everyone's best interest that tax payer dollars are spent as efficiently as possible.

3.2 Goals

The goal of the VECP Program is to ensure the fair and expeditious review of all VECPs for either acceptance or rejection on NCDOT projects.

3.3 Definitions

See the Acronyms and Definitions Section of the VMP Guidelines.

3.4 Roles and Responsibilities

See Section 3.5 below for current roles and responsibilities as they apply to VECP evaluation process.

3.5 VECP Processes

1. A copy of the Final Value Engineering Change Proposal (VECP) shall be submitted by the Contractor to both the Resident Engineer's (RE) office and to Jeffrey M. Garland, P.E., P.M.P., State Value Management Engineer, in Value Management.
2. Value Management will facilitate the evaluation of the VECP by coordinating with RE, Construction Unit, and the appropriate NCDOT engineering disciplines (roadway, structures, geotech, hydro, traffic control, signals, etc.) to determine if the VECP is recommended for approval.
3. Based on the results of this evaluation, a memorandum from Value Management will be sent to Ron Hancock and the RE office with a recommendation either to approve or reject the VECP, a summary of the evaluation results, and the recommended total net savings of the VECP.
4. The Construction Unit makes the final recommendation to approve or reject the VECP and notifies the RE and Value Management.
5. The RE notifies the contractor of the decision.
6. If the VECP is accepted, the necessary changes will be effected by Supplemental Agreement. Included as a part of the Supplemental Agreement will be requirements for price adjustments giving the Contractor 50 percent of the net savings to the project resulting from the modifications.
7. The State Value Management Engineer will ensure that the pertinent information from the VECP is documented in the VMP Database and, in coordination with the Construction Unit, will pursue incorporating engineering practices from accepted VECPs into the appropriate NCDOT policies and standards.

The State Value Management Engineer, in coordination with Department Leadership, has set a goal of facilitating the VECP process and providing recommendations to the Construction Unit within 15 business days after receiving the final VEP from the Contractor.

3.6 Outputs and Reports

See Section 3.5 above for outputs and reports as they apply to VECP Program.

3.7 Program Evaluation

The processes and procedures of the VECP Program are evaluated on an ongoing basis throughout the year. A primary goal of the VECP Program is to consistently evaluate all facets of the program to ensure that it is serving the Department and, ultimately the Citizens of North Carolina, in the most efficient and effective manner possible.

Revisions to the program will be reflected in the Value Management Program Guidelines that are updated on an annual basis. This re-evaluation process will provide the Department an opportunity to modify this program as necessary to incorporate any changes that will enable the program to operate in a more effective manner.

4.0 Risk Assessment Program (RAP)

4.1 Purpose

Risk Assessments (RA) have been performed as part of NCDOT day-to-day business for years; however, the NCDOT Value Management group is striving to formalize internal procedures to incorporate the RA process, when applicable, into the existing VE program or to conduct a RA as a stand alone process. In a recent Rapid Renewal Risk Management Training Workshop prepared for the Strategic Highway Research Program, Golder Associates noted that:

“Risk Management is the formal, structured and imperative process of anticipating and planning for potential problems (“risks”), as well as opportunities (“negative risks”), before they occur, to better understand and control project outcomes (e.g., cost and schedule). It also needs to be adequately accurate and defensible, as well as flexible and efficient, and compatible with the State Highway Agency. The process is applicable to all kinds of projects (including programs or projects).”

Risk Management provides an opportunity to identify and develop management strategies to minimize the risk and optimize the desirable performance.

4.2 Goals

The overall goal of the RAP is to perform risk assessments on various projects for the Department to determine if there are any potential recommendations that can be made to either eliminate or mitigate those risks that are identified.

During a previous SFY, Golder Associates conducted a Risk Assessment for the North Carolina Turnpike Authority (NCTA) on project R-3329/R-2559 (the Monroe Bypass). For SFY 2011-2012, Value Management will be conducting a RA for project U-3321 (Garden Parkway) in coordination with the NCTA.

4.3 Definitions

See the Acronyms and Definitions Section of the VMP Guidelines.

4.4 Roles and Responsibilities

See Section 4.5 below for current roles and responsibilities as they apply to RAP.

4.5 RAP Processes

Value Management will work with the various units throughout the Department to identify projects that may benefit from a risk assessment. Often, risk

assessments will be performed in conjunction with a Value Engineering Study, but they may also be performed independently.

4.6 Outputs and Reports

The Risk Assessments as performed by Value Management will be documented in a report format and often will be included as part of a Value Engineering Study Report. Challenges identified as part of the Risk Assessment will often be utilized in Value Engineering Studies to determine if recommendations can be generated to either eliminate or mitigate the risk.

4.7 Program Evaluation

The processes and procedures of the RAP are evaluated on an ongoing basis throughout the year. A primary goal of the RAP is to consistently evaluate all facets of the program to ensure that it is serving the Department and, ultimately the Citizens of North Carolina, in the most efficient and effective manner possible.

Revisions to the program will be reflected in the Value Management Program Guidelines that are updated on an annual basis. This re-evaluation process will provide the Department an opportunity to modify this program as necessary to incorporate any changes that will enable the program to operate in a more effective manner.

5.0 Product Evaluation Program (PEP)

5.1 Purpose

The purpose of the Product Evaluation Program is to provide a comprehensive evaluation of products to make The North Carolina Department of Transportation's (NCDOT) network safer, move people and goods more efficiently, and make the infrastructure last longer. Another purpose of the program is to determine if evaluated products are viable for use in North Carolina's infrastructure by monitoring installations and providing documentation on their durability and performance.

Products evaluated are typically those that have not been previously evaluated by NCDOT and where a NCDOT standard specification does not exist, or products that have a NCDOT standard specification but require evaluation prior to approval.

Refer all product inquiries to the Product Evaluation Program Engineer:

- Product Evaluation Program Desk: (919) 508-1860
- Product Evaluation Program Email: productevaluation@ncdot.gov
- Product Evaluation Program Website: www.ncdot.org/doh/preconstruct/altern/value/newprod/

5.2 Goals

The Department receives numerous requests for evaluation and approval of products for use on NCDOT infrastructure transportation projects. The primary goal of the PEP is to enable the NCDOT to provide objective, impartial, and consistent evaluation of products for use in the construction, maintenance, and operation of the State's transportation system. Only products that are fully developed, commercially available, and serve a useful function within NCDOT operations will be evaluated.

5.3 Definitions

Approved Product List (APL) – a list of products that have been evaluated and approved by NCDOT for potential use on NCDOT projects.

Oversight Committee – A group comprised of NCDOT leadership personnel to make final decisions on product appeals and resolve non-consensus TWG issues as necessary.

Product – A fully developed, commercially available item for use in the construction, maintenance, and/or operation of the State's transportation system.

Product Evaluation Program (PEP) Engineer – The one-person central contact managing the Product Evaluation Program.

Status Code – The standing assigned to a product as it moves through the decision process. The four status codes are as follows:

“Under Evaluation”: Product is undergoing evaluation consisting of, but not limited to, technical evaluation, laboratory review, calculation verification, and/or field testing.

“Approved”: Product has been evaluated and is approved for use.

“Approved for Provisional Use” (APU): Product has been evaluated and is approved for use based on site specific and/or project specific conditions being met. (NOTE: Work Zone Traffic Control products are given APU status when they are to be used in the field prior to being given a full “Approved” status. The vendor must contact WZTC prior to using it on a NCDOT project.)

“Unapproved”: Product has been evaluated and currently does not meet either the specifications or the needs of the Department. Additionally, a product status may be changed to “Unapproved” if any of the following conditions occur: (Note: this list is not all inclusive)

- Unsatisfactory performance
- Product failure resulting in serious injury or death
- Unsafe product or installation
- Warranty not honored
- Insolvency
- False information submitted on any application, statement, certification, reports or records
- Debarred by Federal or State Agency
- Failure to furnish a non-collusion affidavit upon request
- Evidence of collusion among vendors
- Failure to meet the requirements of an existing guarantee

Technical Work Group (TWG) – A group comprised of NCDOT technical experts (typically 2-5 members) who review submitted products and determine the status of the product. The TWG is composed of representatives from individual NCDOT units that have an established evaluation process and responsibility over specific product categories. The leader of this group is referred to as the TWG Chair.

Vendor – The entity (typically the product manufacturer or distributor) that submits an application for product evaluation.

For additional definitions, see the Acronyms and Definitions Section of the VMP Guidelines.

5.4 Roles and Responsibilities

Several entities comprise the Product Evaluation Program. They are the Vendor, Product Evaluation Program Engineer, Technical Work Groups, various NCDOT Units managing their respective Qualified Products List (QPL), and the Oversight Committee.

Vendor:

Role: Submit product for evaluation

Responsibilities:

- Submit a complete application and supporting documentation electronically using current PEP Application
- Respond in a prompt manner to PEP Engineer and/or TWG member requests for additional information
- As necessary, per the request of NCDOT, provide installation assistance of a product for the purposes of evaluation
- Submit recertification of approved product on an annual basis
- Initiate appeals process, if applicable

Product Evaluation Program Engineer:

The Department has adopted a one-person central contact for all products to be evaluated through the Product Evaluation Program. The PEP Engineer manages the Product Evaluation Program.

Role: Manage and monitor the Product Evaluation Program

Responsibilities:

- Communicate product evaluation process information to the vendor
- Receive product application from vendor
- Review application for completeness
- Follow up with vendor if application is incomplete
- Determine if product category should be evaluated for possible inclusion on the main APL (If not, transfer product application to other appropriate Unit)
- Determine appropriate TWG to evaluate product for possible inclusion on main APL
- As necessary, identify team members for ad-hoc TWGs
- Follow up with TWG on product evaluation progress

- Follow up with TWG on products being monitored in the field
- Notify vendor of product status
- Maintain current product status in APL database
- Oversee distribution of annual recertification notices, and update product status in APL database based on response of recertification notice
- Receive, review and process appeals from vendor
- Elevate non-consensus status decisions to Oversight Committee
- Generate and distribute PEP quarterly results

Technical Work Groups:

The Department has adopted a membership structure that consists of product category-specific Technical Work Groups. These groups are empowered to define product evaluation and determine the status of products.

Role: Evaluate and assess products within their area of technical expertise.

Responsibilities:

- Identify additional members for product evaluation, as needed
- Determine if NCDOT has a need for the product and if an existing NCDOT standard specification applies
- Communicate with vendors and schedule meeting(s), as necessary to complete product evaluation
- Determine an evaluation and monitoring process necessary to determine the product status
- Conduct preliminary investigation regarding other experiences with product (including but not limited to other states, municipalities, contractors, FHWA, NCHRP, etc.)
- Coordinate with vendor in selecting field test site, if necessary to complete evaluation
- Oversee installation and monitor product performance, if necessary to complete evaluation
- Communicate product status decision to PEP Engineer

Note: Individual TWG members may change as necessary, but the established Unit representation will remain.

Other Various NCDOT Units:

Currently, as part of NCDOT's overarching Product Evaluation Program, there are several NCDOT Units that manage their own respective approved or qualified products lists. These Units include, but are not limited to, Materials and Tests, Signals Management, Geotechnical, and Signing and Delineation. For more information and links to these lists, refer to the PEP website.

Oversight Committee:

The Department has adopted the use of an Oversight Committee to make final decisions on product appeals and resolve non-consensus TWG issues as necessary.

Role: Provide oversight of the program.

Responsibilities:

- Make final decisions on product appeals
- Resolve non-consensus TWG issues
- Recommend program improvements

The current Oversight Committee membership structure is:

Name	Position	Unit
Victor Barbour	Director	Technical Services
Kevin Lacy	State Traffic Engineer	Mobility and Safety
Deborah Barbour	Director	Preconstruction
Edward Parker*	Assistant Division Administrator*	FHWA*

*Utilized on an as needed basis

5.5 PEP Processes

Products submitted to NCDOT for evaluation must meet the following criteria:

- The vendor must utilize the most recent PEP Application and submit electronically
- The vendor must identify the proposed use of the product
- The product must be directly related to the transportation system
- The product must be fully developed, marketable, and commercially available

Applications:

The vendor must complete the Product Evaluation Program Application form, including all required fields, and include any supporting documentation. If an application is incomplete, the vendor will be notified in writing by the PEP Engineer to provide missing information within 30 days of notification. If the submittal package is still incomplete after 30 days, the product will not be considered for any further review. The vendor must submit a new PEP Application submittal to be considered for future evaluation.

Samples:

Product samples should not be submitted with the application. NCDOT may request product samples later in the process. If requested, the vendor will have 30 days to submit a product sample. Should the vendor fail to submit the product sample within 30 days, the product will not be considered for further review. The vendor must submit a new PEP Application submittal to be considered for future evaluation.

The following is a general description of the PEP Process

1. Receipt and Distribution of Product Application

- Upon receipt of a product application, the PEP Engineer determines if the product should be evaluated for possible inclusion on the main APL. If not, it is transferred to the appropriate Unit to evaluate for possible inclusion on their own respective approved or qualified products lists and they notify the vendor of the decision
- If the product will be evaluated for possible inclusion on the main APL, the PEP Engineer will acknowledge receipt of the application to the vendor in writing and assign an identification number and status code designation of "Under Evaluation" in APL database
- The PEP Engineer will process the application and forward to the appropriate TWG for evaluation

2. Evaluation Process

- TWG determines if product meets NCDOT Specifications
- If product meets NCDOT Specifications, TWG performs evaluation to determine if the product is "Unapproved", "Approved", or "Approved for Provisional Use"
- If product does not meet NCDOT Specifications, TWG determines if the product is needed
- If TWG determines that the product is needed, TWG performs evaluation to determine if the product is "Unapproved", "Approved", or "Approved for Provisional Use"
- If TWG determines the product is not needed, the product is "Unapproved"
- If TWG requests additional information from the vendor, the vendor will have 30 days to comply with the request. If the vendor does not respond within 30 days, the product will not be considered for any further review and the vendor must submit a new PEP Application submittal to be considered for future evaluation. If the vendor requests additional time to submit the requested information, it will be at the discretion of the TWG to grant additional time
- If the TWG determines the product needs to be field tested as part of the evaluation process, the product status will remain "Under Evaluation" for

the duration of the field testing. Subsequent performance feedback will be evaluated to determine final product status. While the Department may locate field test sites on occasion, generally it is the vendor's responsibility to locate a suitable field test site and obtain the Department's approval of this site. PEP Engineer will communicate the specific requirements of field testing to the vendor on a per product/project basis. PEP Engineer will track products being field tested.

- TWG notifies PEP Engineer of decision on product status
- PEP Engineer updates product status in APL database
- Vendor is notified in writing of product status

3. Appeals Process

- If vendor does not agree with the determined product status, the vendor may elect to appeal the product status. The vendor must appeal in writing to the PEP Engineer within 30 days of product status notification and the appeal must include new or additional product information
- PEP Engineer determines if the appeal documentation is complete
- If appeal documentation is complete and contains pertinent additional information, the PEP Engineer will forward appeal package to TWG for re-evaluation. (If appeal documentation is not complete or does not contain pertinent additional information, the PEP Engineer notifies vendor that the original product status stands.)
- While maintaining the original product status, the TWG performs a re-evaluation to determine if the product status should be changed.
- TWG notifies PEP Engineer of decision on product status
- If product status has changed, PEP Engineer updates product status in APL database
- PEP Engineer notifies vendor in writing of the TWG's decision of the product status
- If vendor does not agree with the re-evaluated product status, the vendor may elect to appeal the product status for a second and final time. The vendor must appeal to the PEP Engineer electronically within 30 days of product status notification
- PEP Engineer submits all product evaluation documentation to Oversight Committee for final decision on product status
- Oversight Committee notifies PEP Engineer of final product status decision.
- PEP Engineer notifies vendor in writing of the Oversight Committee's final decision of the product status
- Oversight Committee decisions are final and no further appeals will be considered

During the evaluation process, the TWG may request a meeting with the vendor to further discuss the product. Should the vendor fail to respond to this meeting request within 30 days, the product will not be considered for further review. The

vendor must submit a new PEP Application submittal to be considered for future evaluation.

If the vendor requests to meet with the Department, the PEP Engineer will relay this to the TWG and it will be up to the discretion of the Department if a meeting is warranted.

Vendors may not “drop by” for unannounced, unscheduled visits with the PEP Engineer. A meeting must be scheduled and approved in advance.

5.6 Outputs and Reports

The PEP provides a central point of contact for Vendors to pursue possible incorporation of their products by the NCDOT. There are numerous communications, notifications, and reports that are generated through the PEP in regards to maintaining the Approved Products List and the product evaluation process. Reference Section 5.5 above for specifics regarding the outputs and reports as they apply to the PEP.

5.7 Program Evaluation

The processes and procedures of the PEP are evaluated on an ongoing basis throughout the year. A primary goal of the PEP is to consistently evaluate all facets of the program to ensure that it is serving the Department and, ultimately the Citizens of North Carolina, in the most efficient and effective manner possible.

Revisions to the program will be reflected in the Value Management Program Guidelines that are updated on an annual basis. This re-evaluation process will provide the Department an opportunity to modify this program as necessary to incorporate any changes that will enable the program to operate in a more effective manner.

The PEP conducts an annual “State of the PEP” meeting with all the Technical Work Groups to evaluate how the program is operating and to determine if there are any process changes that need to be incorporated.

In addition, for Products with an “Approved” or “Approved for Provisional Use Status”:

- Vendors must recertify their product on an annual basis by the 31st of January. If a recertification is not received by January 31st, the PEP Engineer will change the product status to VOID.
- Recertification Notices with detailed requirements will be sent out in December of each year.

- If at any time, contact information has changed, the vendor must inform the PEP Engineer.
- If the composition of the product changes, notify the PEP Engineer in as soon as practicable, stating the specific changes and the reason for the changes. Based on the submitted information, the product may be re-evaluated.

The State of North Carolina's records retention policy, as well as the NCDOT Quality Enhancement Unit's records retention policy will be observed.

Acceptance of a product for evaluation by the NCDOT is in no way a commitment to purchase, recommend, or specify the product reviewed, regardless of its performance. The vendor shall be responsible for all liabilities and injuries caused by any defect in the design, manufacturing, and/or labeling of their products. The vendor is responsible for keeping NCDOT informed of any changes in the product composition or company structure and contact information. Any changes without proper notification may result in changing the product status to "Unapproved."

6.0 Resource Conservation Program

6.1 Purpose

The purpose of the Resource Conservation Program is to promote and manage the use of recycled and solid waste products and materials throughout the Statewide system of transportation projects per the requirements of NC General Statute (G.S.) 136-28.8. See below for a copy of G.S. 136-28.8.

§ 136-28.8. Use of recycled materials in construction:

- (a) It is the intent of the General Assembly that the Department of Transportation continue to expand its use of recycled materials in its construction and maintenance programs.
- (b) The General Assembly declares it to be in the public interest to find alternative ways to use certain recycled materials that currently are part of the solid waste stream and that contribute to problems of declining space in landfills. The Department shall, consistent with economic feasibility and applicable engineering and environmental quality standards, use:
 - (1) Rubber from tires in road pavements, subbase materials, or other appropriate applications.
 - (2) Recycled materials for guard rail posts, right-of-way fence posts, and sign supports.
 - (3) Recycling technology, including, but not limited to, hot in-place recycling, in road and highway maintenance.
- (c) As a part of its scheduled projects, the Department shall conduct additional research, which may include demonstration projects, on the use of recycled materials in construction and maintenance.
- (d) The Department shall review and revise existing bid procedures and specifications to eliminate any procedures and specifications that explicitly discriminate against recycled materials in construction and maintenance, except where the procedures and specifications are necessary to protect the health, safety, and welfare of the people of this State.
- (e) The Department shall review and revise its bid procedures and specifications on a continuing basis to encourage the use of recycled materials in construction and maintenance and shall, to the extent economically practicable, require the use of recycled materials.

- (f) All agencies shall cooperate with the Department in carrying out the provisions of this section.
- (g) On or before October 1 of each year, the Department shall report to the Division of Environmental Assistance and Outreach of the Department of Environment and Natural Resources as to the amounts and types of recycled materials that were specified or used in contracts that were entered into during the previous fiscal year. On or before December 1 of each year, the Division of Environmental Assistance and Outreach shall prepare a summary of this report and submit the summary to the Joint Legislative Commission on Governmental Operations and the Joint Legislative Transportation Oversight Committee. The summary of this report shall also be included in the report required by G.S. 130A-309.06(c).
- (h) The Department, in consultation with the Department of Environment and Natural Resources, shall determine minimum content standards for recycled materials.
- (i) This section is broadly applicable to all procurements by the Department if the quality of the product is consistent with the requirements of the bid specifications.
- (j) The Department may adopt rules to implement this section. (1989, c. 784, s. 6; 1993, c. 256, s. 3; 1995 (Reg. Sess., 1996), c. 743, s. 9; 1997-443, s. 11A.119(a); 1999-237, s. 27.4; 2001-452, s. 3.6; 2010-31, s. 13.1(e).

6.2 Goals

The goal of the Resource Conservation Program is to meet the requirements of G.S. 136-28.8 through the research, investigation, scoping and identification of highway construction resource conservation opportunities.

6.3 Definitions

See the Acronyms and Definitions Section of the VMP Guidelines.

6.4 Roles and Responsibilities

The use of recycled products on NCDOT projects can be initiated by various Departmental staff including the State Value Management Engineer, Resource Conservation Program Engineer, Recycled Products Taskforce, State Roadway Design Engineer (Design-Bid-Build Projects), Transportation Program Management Director (Design-Build Projects), Contractors, and Division Engineers.

Resource Conservation Program Engineer:

Role: Manage and monitor the Resource Conservation Program and identify opportunities where recycled products can be used.

Responsibilities:

- Provide liaison to the Recycled Products Taskforce.
- Review new projects to determine where recycled products may be used.
- Research and evaluate new and innovative ways to incorporate recycled products into NCDOT transportation projects.
- Serve as a resource to other operating units throughout NCDOT, other agencies, and the general public in advocating and promoting the use of recycled products.

Recycled Products Taskforce:

The Taskforce serves as a central point of contact for various agencies, municipalities, or industries to propose the use of new and innovative recycled products.

Role: Propose, evaluate and assess new and innovative recycled products across a wide cross-section of NCDOT operating units.

Note: Individual Taskforce members may change as necessary, but the established unit representation will remain as summarized above.

State Roadway Design Engineer:

For Design-Bid-Build projects, the State Roadway Design Engineer shall have the authority to initiate and propose the use of recycled products in the project.

Role: Manage the lead in initiating, approving, and incorporating the use of recycled products in traditional Design/Bid/Build projects.

Responsibilities:

- Make final decisions on recycled products used
- Incorporate recycled product special provisions into bid documents
- Incorporate recycled product use into Project Commitments ('Green Sheet')
- Incorporate recycled product use as a % of total contract cost

Transportation Program Management Director:

For Design-Build projects the Transportation Program Management Director shall have the authority to initiate and propose the use of recycled products in the project.

Role: Manage the lead in initiating, approving, and incorporating the use of recycled products in Design-Build projects.

Responsibilities:

- Make final decisions on recycled products used
- Incorporate recycled product use as a % of total contract cost
- Incorporate recycled products into Request for Proposals (RFP's)
- Incorporate recycled products into the contract as Alternate Bid(s)

Contractors (Post-Let):

For Design-Bid-Build projects, after the contract has been awarded the Contractor shall have the right to request the use of recycled products.

Role: Initiate the use of recycled products in accordance with Section 104-13 (January 2012) of the Standard Specifications for Roads and Structures.

Responsibilities:

- Submit statement to request modification of contract be made as a recycled products proposal
- Provide a description of differences between the existing contract requirements and the proposed modification and the comparative advantages and disadvantages of each
- Provide a complete drawing of the details covering the proposed modifications and supporting computations in the submittal
- Provide an itemized list of the contract requirements that would be modified along with a recommendation of how to make each modification.
- Provide a detailed estimate of the cost of performing the work under the proposed modification
- Provide a statement of the time by which approval of the proposal shall be issued by the NCDOT to maintain the completion date of the contract

If a new product is not on the Qualified Recycling Products List, the necessary changes will be effected by Supplemental Agreement.

Note: See paragraphs (A), (B), and (C) of the specification (Section 104-13) for further details and requirements.

The Department reserves the right to reject at its discretion any recycled products proposal and will not be liable to the Contractor for failure to accept or act upon any recycled products proposal submitted nor for any delays to the work attributable to any third party claims, or fines that may be levied as a result of the Contractor's decision to use targeted recycled products.

Division Engineers:

Role: Division Engineers shall have the right to initiate, propose, and approve (or deny) the use of recycled products for any projects within their respective Division so long as the approval (or denial) of same is not unreasonably granted or withheld. In addition, the use of recycled products and/or materials that are incorporated as part of that Division's maintenance operations shall be used at the Division Engineer's discretion.

6.5 RCP Processes

See Section 6.4 above for current practices as they apply to RCP process.

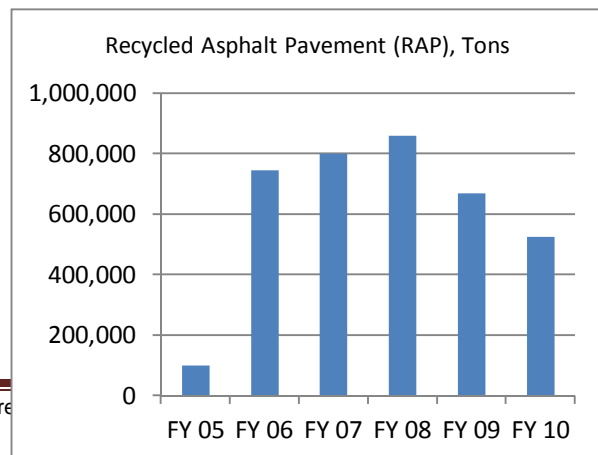
6.6 Outputs and Reports

Over the past twenty years, the NCDOT has utilized a variety of recycled products and solid waste materials including scrap tires, coal ash, recycled plastics, recycled glass, recycled asphalt, and recycled concrete on construction and maintenance projects in all 14 Highway Divisions across the state. The NCDOT Resource Conservation Program in the Quality Enhancement Unit has an extensive amount of data regarding efforts of the Department to reduce impacts to North Carolina landfills.

The RCP coordinates with all 14 Divisions, NCDENR, and other NCDOT Units to prepare the annual Reduce, Reuse, and Recycle Report that details the numerous efforts made by the Department in response to G.S. 136-28.8.

Below is an overview of three types of recycled products which the Department has used on a regular basis over the past five years. These recycled products are asphalt pavement, coal ash as a concrete mix additive, and plastic guardrail off-set blocks.

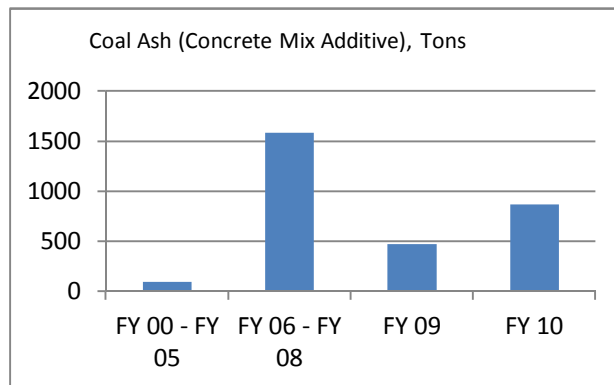
Reclaimed Asphalt Pavement (RAP): Reclaimed or recycled asphalt pavement (RAP) is the term given to removed and/or reprocessed pavement materials containing asphalt and aggregates. These materials are generated when asphalt pavements are removed for



reconstruction, resurfacing, or to obtain access to buried utilities. The most frequent application is the re-use of the reclaimed asphalt pavement to produce recycled hot-mix asphalt (HMA). NCDOT's specifications allow that RAP may constitute up to 50% of the total material used in recycled asphalt mixtures although in most instances it ranges between 6% and 15% (with the balance of the mix being made up of 'virgin' or non-recycled materials). Most of the RAP used by NCDOT is for repair work and shoulder construction although there is good potential to use it on resurfacing contracts in the future. The rolling average use since 1989 has been over 225,000 tons per year and since 2005, it has been considerably higher. This trend is expected to continue given the potential for 'virgin' asphalt prices to continue to rise.

Coal Ash (Concrete Mix Additive):

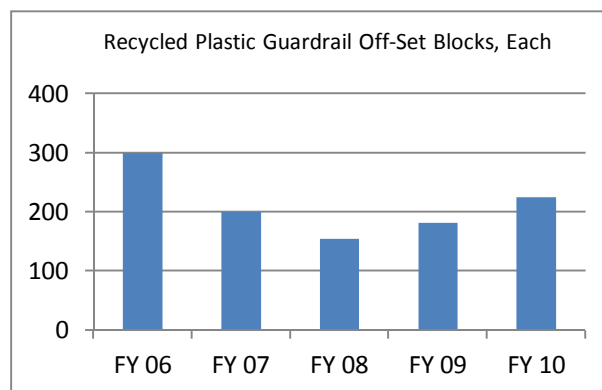
For many years it has been an industry-wide practice to use coal ash in concrete mixes as a substitute for Portland cement and to increase the plasticity and workability of the wet concrete. Because Portland cement is a commodity that is becoming scarcer and more costly, the use of coal ash



in its place has been steadily increasing and since at least 1994, NCDOT has been specifying coal ash in concrete mixes. Although its use remained fairly consistent between 1994 and 2005, it peaked in 2006 through 2008. It is believed that between 2006 and 2008, the cost of concrete came down to a level comparable to asphalt and so many projects constructed in this time frame used concrete instead of asphalt. Although the use of concrete tailed-off considerably after 2008, its use has been steadily increasing over the past 2 years.

Recycled Plastic Guardrail Off-Set Blocks:

Since at least 1997 (when tracking began), the NCDOT has utilized recycled plastic guardrail off-set blocks (in place of wood blocks) on a consistent basis and between 2008 and 2010 its use has increased. This trend is expected to continue to the point that the use of recycled plastic guardrail off-set blocks may likely become standard



practice and the use of wood blocks will become more limited. Using recycled plastic guardrail off-set blocks preserves a natural resource in wood and allows the use of certain post-consumer plastic waste materials that are used in the manufacturing of the recycled plastic blocks to be diverted away from landfills. In addition to the off-set blocks, NCDOT has also used recycled plastic fence posts

and recycled plastic delineator posts on a number of projects and this use is expected to continue as well.

6.7 Program Evaluation

The processes and procedures of the RCP are evaluated on an ongoing basis throughout the year. A primary goal of the RCP is to consistently evaluate all facets of the program to ensure that it is serving the Department and, ultimately the Citizens of North Carolina, in the most efficient and effective manner possible.

Revisions to the program will be reflected in the Value Management Program Guidelines that are updated on an annual basis. This re-evaluation process will provide the Department an opportunity to modify this program as necessary to incorporate any changes that will enable the program to operate in a more effective manner.

7.0 Constructability Review Program (CRP)

7.1 Purpose

The purpose of the Constructability Review (CR) Program is to review projects prior to Let of the contract to ensure that the design has been optimized from a constructability standpoint. The CR will focus on constructability issues and may include Contractors in addition to NCDOT staff. It should be emphasized that any project can be scheduled for a Constructability Review if it is deemed that the project would benefit from such a review.

Constructability issues to consider as part of the review include, but are not limited to, the following:

- Traffic control phasing
- Staging areas
- Site access
- Phasing of the project
- Contracting options
- Time constraints
- Materials
- Construction methods

7.2 Goals

The primary goal of the Constructability Review Program is to ensure that the project design has been optimized from a constructability standpoint and that contractors and other NCDOT construction staff have had an opportunity to comment on the design prior to Let of the contract.

Additional goals of the CRP are:

- Arrange for the involvement of several agencies, AGC, NCDOT design personnel, NCDOT Division personnel, and FHWA to visit the project site.
- Conduct approximately 10 – 12 Constructability Reviews each year.
- Conduct Constructability Reviews early in the design phase to maximize potential cost savings.
- Provide an opportunity for NCDOT design staff to gain knowledge in construction practices and methodologies to facilitate future design work for the Department.

7.3 Definitions

See the Acronyms and Definitions Section of the VMP Guidelines.

7.4 Roles and Responsibilities

See Section 7.5 below for current roles and responsibilities as they apply to the CRP.

7.5 CRP Processes

The Department has been utilizing constructability type reviews for several years and various units have assisted with facilitating these reviews. Most recently, both the Traffic Management Unit and the Transportation Program Management Unit have performed constructability reviews for the Department. Value Management will continue to coordinate with both of these units as it carries this program forward.

In general, below are some of the key points in the Constructability Review process.

- Value Management will establish a team assembled of senior level engineers and designers from NCDOT, private engineering firms, and contractors to perform constructability reviews.
- Value Management will facilitate the Constructability Review process, meetings, and post-review work.
- Value Management will create a Constructability Review report based on the constructability review team's recommendations.
- The constructability reviews will focus primarily on the following:
 - Lower the construction costs through alternative design and contractor identified cost savings
 - Can the project, as detailed in the plans and specifications, be constructed using standard construction methods, materials and techniques.
 - Do the plans and specifications provide the contractor with clear, concise information that can be utilized to prepare a competitive, cost-effective bid.
 - Can the work, when constructed in accordance with the plans and specifications, result in a project that can be maintained in a cost-effective manner by the Department over the life of the project.

7.6 Outputs and Reports

After the completion of a constructability review, a report shall be created which will include the recommendations from the constructability review team. Each

member of the review team will receive copies of the final constructability review report.

7.7 Program Evaluation

The processes and procedures of the CRP are evaluated on an ongoing basis throughout the year. A primary goal of the CRP is to consistently evaluate all facets of the program to ensure that it is serving the Department and, ultimately the Citizens of North Carolina, in the most efficient and effective manner possible.

Revisions to the program will be reflected in the Value Management Program Guidelines that are updated on an annual basis. This re-evaluation process will provide the Department an opportunity to modify this program as necessary to incorporate any changes that will enable the program to operate in a more effective manner.

8.0 Post Construction Assessment Program (PCAP)

8.1 Purpose

The purpose of the Post Construction Assessment Program (PCAP) is to be a liaison between the Design Engineers and the Construction Unit in an effort to incorporate lessons learned during construction into future designs. These lessons learned include vital information related to construction techniques, materials, standard details and designs, etc. It allows for NCDOT to adjust future cost estimates and, update standards, and change policies to continuously strive to be an effective organization that works well.

8.2 Goals

The goal of the PCAP is to provide the means to capture lessons learned post construction so that they can be taken back to the designers for future incorporation. Additionally, when trends are identified, changes could be incorporated into the Department's standards and policies.

8.3 Definitions

CQI – Construction Quality Index

Failing CQI Report Form – Any individual element with a rating of “6” or less has an in depth investigation performed and the Failing Construction Quality Index Report Form is filled out and submitted to the Construction Unit.

Overrun Report – Report generated by the Construction Unit detailing quantities that were overrun on projects.

For more definitions, see “Acronyms and Definitions” at the front of this document.

8.4 Roles and Responsibilities

See Section 8.5 below for current roles and responsibilities as they apply to the PCAP.

8.5 PCAP Processes

The PCAP Manager is coordinating with the Construction Unit to identify the best way to capture the lessons learned and bridge this information to designers. A formalized process will be developed during FFY 2012. Ideas being generated to develop this process include onsite project visits which include design staff, the use of existing construction reports (CQI, overrun report), electronic feedback

forms, etc. These sources will allow the PCAP Manager to identify trends which need to be incorporated into designs.

8.6 Outputs and Reports

VMP engineer reviews the overrun report generated by the Construction Unit and identifies trends in quantity over/underruns.

When a Post Construction Assessment is performed, the PCAP Engineer will compose a report summarizing the lessons learned to distribute out to the appropriate Department personnel.

In the VMP year end report, the VMP Engineer will include a report of how many Post Construction Assessments are done, what the outcomes were, how many of the suggestions or comments resulted in policy changes, and what the outcomes were. The VMP Engineer will also provide a report summarizing the number of feedback forms submitted by contractors and Resident Engineers.

8.7 Program Evaluation

The processes and procedures of the PCAP are evaluated on an ongoing basis throughout the year. A primary goal of the PCAP is to consistently evaluate all facets of the program to ensure that it is serving the Department and, ultimately the Citizens of North Carolina, in the most efficient and effective manner possible.

Revisions to the program will be reflected in the Value Management Program Guidelines that are updated on an annual basis. This re-evaluation process will provide the Department an opportunity to modify this program as necessary to incorporate any changes that will enable the program to operate in a more effective manner.

Appendix A – FHWA CFR 23 Part 627 – Value Engineering

§ 627.1 Purpose and applicability.

(a) This regulation will establish a program to improve project quality, reduce project costs, foster innovation, eliminate unnecessary and costly design elements, and ensure efficient investments by requiring the application of value engineering (VE) to all Federal-aid highway projects on the National Highway System (NHS) with an estimated cost of \$25 million or more.

(b) In accordance with the Federal-State relationship established under the Federal-aid highway program, State transportation departments (STDs) shall assure that a VE analysis has been performed on all applicable projects and that all resulting, approved recommendations are incorporated into the plans, specifications and estimate.

§ 627.3 Definitions.

Project. A portion of a highway that a State proposes to construct, reconstruct, or improve as described in the preliminary design report or applicable environmental document. A project may consist of several contracts or phases over several years.

Value engineering. The systematic application of recognized techniques by a multi-disciplined team to identify the function of a product or service, establish a worth for that function, generate alternatives through the use of creative thinking, and provide the needed functions to accomplish the original purpose of the project, reliably, and at the lowest life-cycle cost without sacrificing safety, necessary quality, and environmental attributes of the project.

§ 627.5 General principles and procedures.

(a) **State VE programs.** State transportation departments must establish programs to assure that VE studies are performed on all Federal-aid highway projects on the NHS with an estimated cost of \$25 million or more. Program procedures should provide for the identification of candidate projects for VE studies early in the development of the State's multi-year Statewide Transportation Improvement Program.

(1) **Project selection.** The program may, at the State's discretion, establish specific criteria and guidelines for selecting other highway projects for VE studies.

(2) **Studies.** Value engineering studies shall follow the widely recognized systematic problem-solving analysis process that is used throughout private industry and governmental agencies. Studies must be performed using multi-

disciplined teams of individuals not personally involved in the design of the project. Study teams should consist of a team leader and individuals from different specialty areas, such as design, construction, environment, planning, maintenance, right-of-way, and other areas depending upon the type of project being reviewed. Individuals from the public and other agencies may also be included on the team when their inclusion is found to be in the public interest.

- (i) Each team leader should be trained and knowledgeable in VE techniques and be able to serve as the coordinator and facilitator of the team.
 - (ii) Studies should be employed as early as possible in the project development or design process so that accepted VE recommendations can be implemented without delaying the progress of the project.
 - (iii) Studies should conclude with a formal report outlining the study team's recommendations for improving the project and reducing its overall cost.
- (3) Recommendations. The program should include procedures to approve or reject recommendations and ensure the prompt review of VE recommendations by staff offices whose specialty areas are implicated in proposed changes and by offices responsible for implementing accepted recommendations. Reviews by these offices should be performed promptly to minimize delays to the project.
- (4) Incentives. The program may include a VE or cost reduction incentive clause in an STD's standard specifications or project special provisions that allows construction Contractors to submit change proposals and share the resulting cost savings with the STD.
- (5) Monitoring. The program should include procedures for monitoring the implementation of VE study team recommendations and VE change proposal recommendations submitted by construction Contractors.
- (b) State VE coordinators. Individuals knowledgeable in VE shall be assigned responsibilities to coordinate and monitor the STD's program and be actively involved in all phases of the program.
- (c) Use of consultants. Consultants or firms with experience in VE may be retained by STDs to conduct the studies of Federal-aid highway projects or elements of Federal-aid highway projects required under §627.1(a) of this part. Consultants or firms should not be retained to conduct studies of their own designs unless they maintain separate and distinct organizational separation of their VE and design sections.

(d) Funding eligibility. The cost of performing VE studies is project related and is, therefore, eligible for reimbursement with Federal-aid highway funds at the appropriate pro-rata share for the project studied.

(e) In the case of a Federal-aid design-build project meeting the project criteria in 23 CFR 627.1(a), the STDs shall fulfill the value engineering analysis requirement by performing a value engineering analysis prior to the release of the Request for Proposals document.

Appendix B – NCDOT VMP Policy

(see following page)



North Carolina Department of Transportation Quality Enhancement Unit Value Management



Value Management Program Policy

November 15, 2011

Policy Statement

It is the policy of the North Carolina Department of Transportation to administer the Value Management Program (VMP) on a statewide basis to ensure the prudent use of funds and resources on transportation infrastructure projects. The VMP provides the Department a centralized management group that focuses on establishing Departmental procedures to pursue cost efficiencies, mitigate project risks, standardize product approvals, utilize resource conservation opportunities, and incorporate the consideration of construction methodologies throughout the planning, design, construction, and maintenance stages of transportation infrastructure projects.

The North Carolina Department of Transportation Value Management Program is composed of multiple interrelated department-wide programs working together to serve the Department as a vital resource and information clearinghouse. Because of the broad range of responsibilities within the Value Management Program, the guidelines providing procedures and processes for each individual program have been established in a document titled "NCDOT Value Management Program Guidelines." An annual review of these guidelines ensures the programs are functioning effectively and efficiently and the updated guidelines are published at the end of each calendar year.

Goals & Objectives

The primary goal of the VMP is to serve the Department by providing valuable information to the appropriate planning, design, construction, and maintenance staff at the opportune time to ensure the effective use of statewide resources.

The major objectives of the VMP are:


- To provide the means for the NCDOT to utilize value engineering techniques at each major decision point within the project development process.

- To seek design improvements, project cost savings, accelerated incorporation of new materials and construction techniques into projects, improved constructability, reduced environmental impacts, accelerated project schedules, reduced project risk, and improved transportation infrastructure operations.
- To provide the means for the Department to efficiently implement lessons learned throughout the VE process into project planning, design, construction, and maintenance throughout the state.
- To provide the Department an effective resource to evaluate products for possible approval for use on statewide projects within NCDOT right of way.
- To train the Department on Value Management.

Department Approval

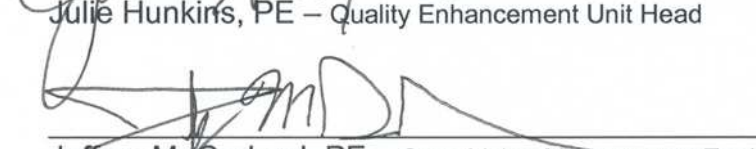
Given the growing population of North Carolina and the changing needs of its citizens, it is imperative that the Department embrace the importance of value management principles. The ability to maximize the effectiveness of tax payer dollars is paramount to the Department's success in providing efficient, safe, and reliable transportation to the citizens of North Carolina and the communities it serves.

The North Carolina Department of Transportation Value Management Program Policy is approved by:


Terry R. Gibson, PE – State Highway Administrator


J. Victor Barbour, PE – Administrator of the Technical Services Division


Julie Hunkins, PE – Quality Enhancement Unit Head


Jeffrey M. Garland, PE – State Value Management Engineer